



Title	Two Flashover Cell Experiments		
Test Type	Custom		
Lab Number	08FE0001-1		
Test dates	9/5/08	No. Tests	2

Thermocouples

Thermocouples are temperature measurement sensors that consist of two dissimilar metals joined at one end (a junction) that produces a small thermo-electrical voltage when the wire is heated. The change in voltage is interpreted as a change in temperature [1]. There are many configurations of thermocouples which affect the temperature range, ruggedness, and response time. The information required to identify these factors for the thermocouples that were used during the experiment(s) conducted for this test series is provided in the “Thermocouple Measurement Description” table.

Thermocouples used during this test series were used in accordance with the method defined in FRL laboratory instruction “LI001 Thermocouple” [2].

The following table provides a description of the instrumentation used to collect the temperature measurements during the experiments. The "Description" column describes the location of the temperature measurement. The "Z" location is the height of the thermocouple above the floor. The "Thermocouple Type" describes the characteristics of the thermocouple used.

Table 1. Thermocouple Measurement Description

Description	Z (m)	Thermocouple type
0.001 m	0	Type K, Glass Ins., 24 AWG wire
0.61 m	7.32	Type K, Glass Ins., 24 AWG wire
1.22 m	1.22	Type K, Glass Ins., 24 AWG wire
1.52 m	1.52	Type K, Glass Ins., 24 AWG wire
1.83 m	1.83	Type K, Glass Ins., 24 AWG wire
2.13 m	2.13	Type K, Glass Ins., 24 AWG wire
2.4 m	29.26	Type K, Glass Ins., 24 AWG wire
0.61 m	0.61	Type K, Glass Ins., 24 AWG wire
2.4 m	2.44	Type K, Glass Ins., 24 AWG wire

Experiment Photographs

Digital Cameras are used within the FRL to record digital still photographs during experiments. Digital Cameras used during this test series were used in accordance with the method defined in FRL Laboratory Instruction “LI003 Digital Cameras” [3].

Results for Test 1 (ID 3710)

The following table provides a summary of the temperature results. The “Initial” column provides the measured temperature at the beginning of the test. The maximum temperature recorded during the test is provided in the “Max” column. The remaining columns provide the calculated maximum average temperatures.

Table 2. Temperature Value Result Summary

Description	Initial (C)	Max (C)	30 second maximum average (C)	60 second maximum average (C)	300 second maximum average (C)	600 second maximum average (C)
0.001 m	29	696	435	285	85	57
0.61 m	29	911	673	417	112	71
1.22 m	30	1029	852	512	131	80
1.52 m	30	1008	906	655	167	98
1.83 m	30	958	911	758	210	120
2.13 m	31	934	901	785	227	129
2.4 m	32	956	886	770	231	131

The following table shows which thermocouple(s) were taken out of service during the experiment.

Table 3. Out of Service Times

Description	Time out of service (s)
1.22 m	210
1.52 m	210

The following chart(s) present a time-dependent representation of the instantaneous temperatures measured during the experiment.

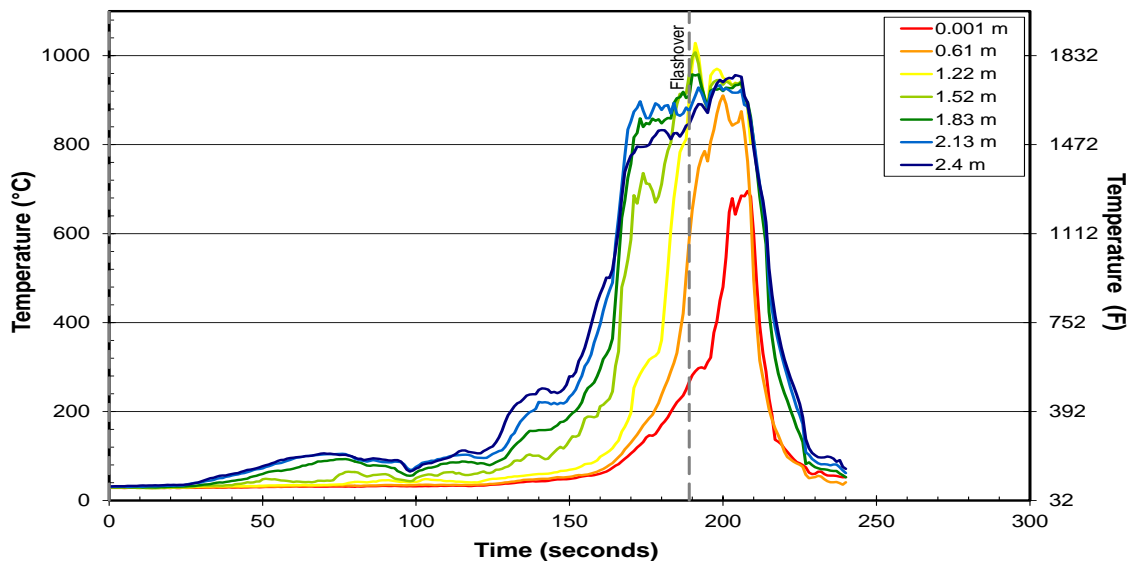


Figure 1. Temperature

The following table lists selected events that occurred during the experiment.

Table 4. Experiment Events

Description	Time (s)
Suppression	
Flashover	189

The following table provides a description of the video(s) taken during this experiment.

Table 5. Video Log

Description	Filename
Burn01	3710_84564.mp4

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.



Figure 2. PRE (0:09 hr:min),
3710_14603

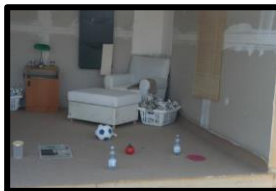


Figure 3. PRE (0:09 hr:min),
3710_14604



Figure 4. PRE (0:09 hr:min),
3710_14605

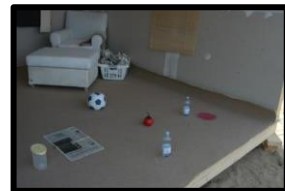


Figure 5. PRE (0:08 hr:min),
3710_14608



Figure 6. PRE (0:08 hr:min),
3710_14609



Figure 7. PRE (0:01 hr:min),
3710_14613



Figure 8. PRE (0:00 hr:min),
3710_14615



Figure 9. PRE (0:00 hr:min),
3710_14616

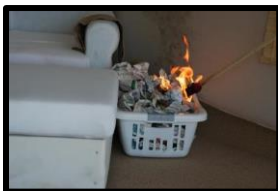


Figure 10. 0,
3710_14618

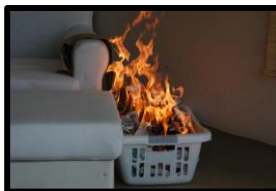


Figure 11. 22,
3710_14623

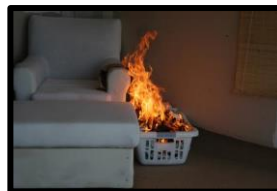


Figure 12. 28,
3710_14625



Figure 13. 40,
3710_14628



Figure 14. 60,
3710_14632



Figure 15. 108,
3710_14638

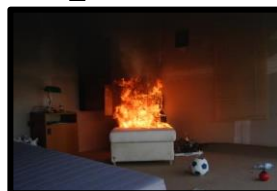


Figure 16. 121,
3710_14641



Figure 17. 132,
3710_14644



Figure 18.



Figure 19. 164,
3710_14650



Figure 20. 169,
3710_14652



Figure 21. 194,
3710_14660



Figure 22. 203,
3710_14668



Figure 23. 209,
3710_14672



Figure 24. 232,
3710_14679

Results for Test 2 (ID 3711)

The following table provides a summary of the temperature results. The “Initial” column provides the measured temperature at the beginning of the test. The maximum temperature recorded during the test is provided in the “Max” column. The remaining columns provide the calculated maximum average temperatures.

Table 6. Temperature Value Result Summary

Description	Initial (C)	Max (C)	30 second maximum average (C)	60 second maximum average (C)	300 second maximum average (C)	600 second maximum average (C)
0.001 m	28	204	153	119	49	39
0.61 m	28	886	514	309	87	57
1.52 m	28	979	824	526	133	80
1.83 m	29	939	856	598	158	93
2.13 m	28	944	886	665	176	102
2.4 m	30	935	858	673	185	107

The following table shows which thermocouple(s) were taken out of service during the experiment.

Table 7. Out of Service Times

Description	Time out of service (s)	Out of service reason
1.52 m	93	

The following chart(s) present a time-dependent representation of the instantaneous temperatures measured during the experiment.

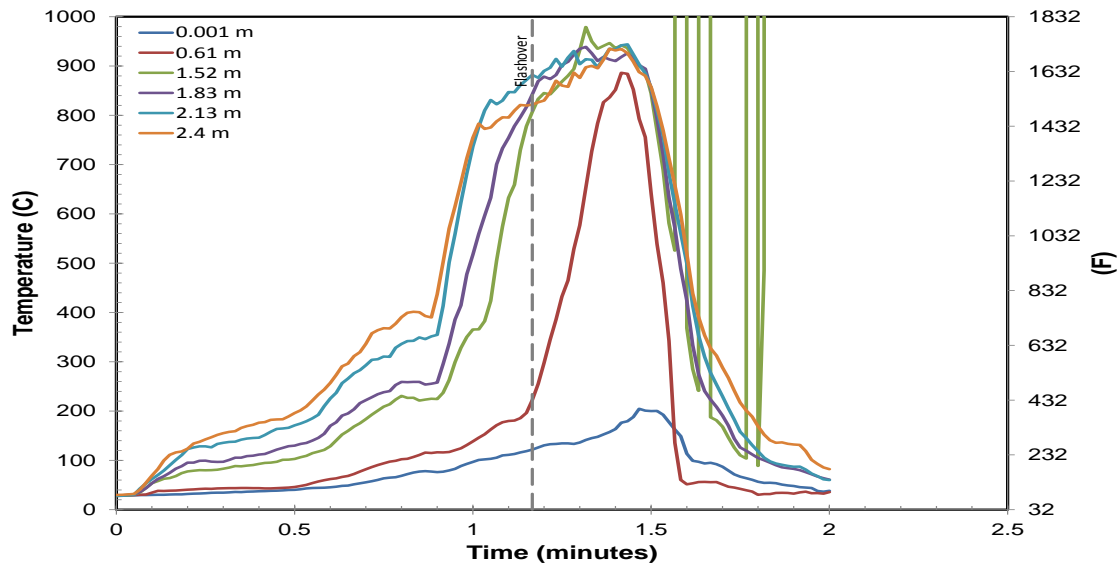


Figure 25. Temperature

The following table lists selected events that occurred during the experiment.

Table 8. Experiment Events

Description	Time (s)
Suppression	
Flashover	70

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.



Figure 26. PRE
(0:31 hr:min),
3711_14681



Figure 27. PRE
(0:02 hr:min),
3711_14684



Figure 28. PRE
(0:02 hr:min),
3711_14685



Figure 29. PRE
(0:00 hr:min),
3711_14689



Figure 30. PRE
(0:00 hr:min),
3711_14690



Figure 31. 0,
3711_14692



Figure 32. 1,
3711_14693



Figure 33. 4,
3711_14694



Figure 34. 6,
3711_14695



Figure 35. 8,
3711_14696



Figure 36. 9,
3711_14697



Figure 37. 13,
3711_14699



Figure 38. 18,
3711_14701



Figure 39. 22,
3711_14703



Figure 40. 27,
3711_14705



Figure 41. 32,
3711_14707



Figure 42. 36,
3711_14709



Figure 43. 47,
3711_14711



Figure 44. 52,
3711_14713



Figure 45. 56,
3711_14715



Figure 46. 64,
3711_14717



Figure 47. 68,
3711_14719



Figure 48. 70,
3711_14721



Figure 49. 71,
3711_14722



Figure 50. 72,
3711_14723



Figure 51. 74,
3711_14725



Figure 52. 79,
3711_14727



Figure 53. 82,
3711_14729



Figure 54. 88,
3711_14735



Figure 55. 91,
3711_14737

References

1. The Temperature Handbook, 2nd edition, Omega Engineering, Stamford, CT, 2000.
2. Laboratory Instruction LI001 - Thermocouple, Bureau of Alcohol, Tobacco, Firearms and Explosives – Fire Research Laboratory, Beltsville, MD.
3. Laboratory Instruction LI003 - Digital Cameras, Bureau of Alcohol, Tobacco, Firearms and Explosives - Fire Research Laboratory, Beltsville, MD